UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/748,141	12/27/2000	Yoshihisa Abe	44319-056	3302

7590 02/24/2004	**EXAMINER**
Kenneth L. Cage, Esquire	MCCARTNEY, LINZY T
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ART UNIT	PAPER NUMBER
2671	13

DATE MAILED: 02/24/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) FROM
THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed
after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any
earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on <u>01 December 2003</u>.

2a)☒ This action is **FINAL.**   2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is
closed in accordance with the practice under *Ex parte Quayle,* 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) <u>1-22</u> is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) <u>1,3-8,14,15 and 17-22</u> is/are rejected.

7)☒ Claim(s) <u>2, 9-13, and 16</u> is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All b)☐ Some * c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____.

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage
application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☐ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
    Paper No(s)/Mail Date _____.

4)☐ Interview Summary (PTO-413)
    Paper No(s)/Mail Date. _____.

5)☐ Notice of Informal Patent Application (PTO-152)

6)☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set

forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this
> title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole
> would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter
> pertains. Patentability shall not be negatived by the manner in which the invention was made.

2.   Claims 1, 3, 8, and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Garland et al.,

"Surface Simplification Using Quadric Error Metrics" (Garland) in view of U.S. Patent No. 5,590,248 to Zarge

et al (Zarge).

        a.   Referring to claim 1, Garland discloses calculating estimation values for surfaces to be deformed

by shrinking edges or surfaces of a polygon model by converging two or more vertices of the polygon

model based on distances between the respective surfaces <u>after each deformation</u> and all <u>of</u> the original

vertices involved in the surface deformation ("...We can associate a set of planes ...we can define the

error of the vertex with respect to this set as the sum of squared distances to it planes... " - page 4,

paragraph 1 and ". ..Compute the Q matrices for all initial vertices . . . The error . . . of this target vertex

becomes the cost of contracting this pair... place all the pairs in a heap keyed on cost...Iteratively remove

the pair...update the costs of all valid pairs involved..." - page 3, Section 4.1,paragraph 2) and reducing

the number of data for the polygon model by shrinking edges or surfaces of the polygon model ("...

Iteratively remove the pair . . . contract this pair... " - page 3, Section 4.1, paragraph 2 and Figure 1).

Garland does not expressly disclose comparing the calculated estimation values with a predetermined

permissible value or reducing the number of data when the estimation values are equal to or below the

predetermined permissible value. Zarge discloses a method for reducing the complexity of a polygonal

mesh by comparing a calculated estimation value with a predetermined permissible value and reducing

the number of data when the estimation values are equal to or below the predetermined permissible

value ("... if the distance is less than a pre-selected decimation threshold..." - column 3, line 7-12 and

Fig. 1). At the time the invention was made, it would have been obvious to a person of ordinary skill in

the art to modify the method of Garland to compare the calculated estimation values with a

predetermined permissible value and reduce the number of data when the estimation values are equal to

or below the predetermined permissible value as taught by Zarge because it would allow the user to

specify a target reduction ("The user can specify the target reduction..." - Zarge, column 4, lines 49-56).

b.   Referring to claim 3, Garland discloses the polygon model includes a number of triangular

polygons ("We assume that the model consists of triangles only..." - page 1, paragraph 4).

c.   Claim 8 is rejected with the rationale of the rejection of claim 1. Claim 8 is

merely claim 1 recited as an apparatus.

d.   Claim 14 is rejected per claim 8 with the rationale of the rejection of claim. Claim 14 is merely

claim 3 recited as an apparatus.

3.   Claims 4-7, 15, 17-19 and 21-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Garland

in view of U.S. Patent No. 6,262,737 to Li et al. (Li).

a.   Referring to claim 4, Garland discloses calculating respective estimation values for a plurality of

portions of a polygon model that are to be deformed by converging two or more vertices of the polygon

model ("... Compute the Q matrices for all initial vertices.... The error...of this target vertex becomes the

cost of contracting this pair..." - page 3, Section 4.1, paragraph 2) and reducing the number of data for

the polygon model by converging two or more vertices of one portion of the polygon model based on the

calculated estimation values after another portion, repeatedly ("...Iteratively remove the pair... contract

this pair..."- page 3, Section 4.1, paragraph 2 and Figure 1). Garland does not disclose wherein before

each data reduction, the portion that the estimation value thereof is necessary to be recalculated as a

result of the previous data reductions is defined as a reduction prohibition area, and a succeeding data

reduction is applied to a portion other than the reduction prohibition area. Li discloses performing

independent edge collapses, i.e. edge collapses that do not share a vertex ("...two edge collapse

operations...are independent of each other if they do not share any common vertex ...a mesh

simplification may be conducted ...where independent edge collapses are performed in the same layer..."

- column 12, lines 22-35). Inherently, to ensure the aforementioned edge collapses are independent they

must be marked in some fashion. Note that in the method of Garland, the estimation values are only

recalculated for those portions previously involved in a removal ("...contract this pair, and update the

costs of all pairs involving vi..." - page, 3, column 2, paragraph 4). At the time the invention was made,

it would have been obvious to a person of ordinary skill in the art to modify the method of Garland to

perform independent edge collapses as taught by Li. The suggestion/motivation for doing so would have

been to fore pair contractions to be spread evenly over the surface of the model to ensure the model is

simplified across its entire surface in a balanced way (Li, column 12, lines 32-35).

b.   Claim 5 is rejected per claim 4. The modified method of Garland as applied to claim 4 meets the

limitations recited in claim 5 except "...wherein the reduction prohibition area is released if a

predetermined condition is satisfied." Li discloses that mesh simplification is performed on several

consecutive layers and independent edge collapses are performed in the same layer ("... mesh

simplification may be conducted through several consecutive layers... independent edge collapses are

performed in the same layer..." – column 12, lines 28-30), so upon simplification of each layer the

prohibition area is released. At the time the invention was made, it would have been obvious to a person

of ordinary skill in the art to modify the method of Garland to release the reduction prohibition area if a

predetermined condition is satisfied as taught by Li. The suggestion\motivation for doing so would have

been to force pair contractions to be spread evenly over the surface of the model to ensure the model is

simplified across its entire surface in a balanced way (Li, column 12, lines 32-35).

c.   Claims 6 and 7 are rejected per claim 5. The modified method of Garland as applied to claim 5

meets the limitations recited in claims 6 and 7. As noted in the rejection of claim 5 above the reduction

prohibition area is lifted after all vertices have been processed for a particular layer which meets the

limitations recited in claims 6 and 7.

d.   Referring to claim 15, Garland discloses an estimation calculator which calculates respective

estimation values for a plurality of portions of a polygon model that are to be deformed by converging

two or more vertices of the polygon model ("... Compute the Q matrices for all initial vertices . . . The

error. . . of this target vertex becomes the cost of contracting this pair..." - page 3, Section 4.1, paragraph

2; ". . . an SGI Indigo2 with a 195 MHz 810000 processor and 128 Mbytes of memory." - page 5,

footnote), a judging device which judges based on a calculated estimated value whether a portion of the

polygon model is permissible for the deformation ("...iteratively remove the pair (vi, v2) of least cost

from the heap..."; ". . . an SGI Indigo2 with a 195 MHz 810000 processor and 128 Mbytes of memory." -

page 5, footnote), and a data reducing device which reduces the number of data for the polygon model

by converging two or more vertices of one portion of the polygon model based on the calculated

estimation values after another portion, repeatedly ("...Iteratively remove the pair ...contract this pair... "

- page 3, Section 4.1, paragraph 2 and Figure 1; ". . . an SGI Indigo2 with a 195 MHz 810000 processor

and 128 Mbytes of memory." - page 5, footnote). Garland does not disclose a prohibition area defining

device which defines a portion that the estimation value thereof is necessary to be recalculated as a result

of the previous data reductions is defined as a reduction prohibition area, and a succeeding data

reduction is applied to a portion other than the reduction prohibition area to keep succeeding data

reduction from being applied. Li discloses performing independent edge collapses, i.e. edge collapses

that do not share a vertex (". . .two edge collapse operations... are independent of each other if they do

not share any common vertex. . . a mesh simplification may be conducted ...where independent edge

collapses are performed in the same layer..." - column 12, lines 22-35). Inherently, to ensure the

aforementioned edge collapses are independent they must be marked in some fashion. Note that in the

method of Garland, the estimation values are only recalculated for those portions previously involved in

a removal (". . . contract this pair, and update the costs of all pairs involving vi... " - page, 3, column 2, paragraph 4). At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to modify the method of Garland to perform independent edge collapses as taught by Li. The suggestion\motivation for doing so would have been to force pair contractions to be spread evenly over the surface of the model to ensure the model is simplified across its entire surface in a balanced way (Li, column 12, lines 32-35).

e.   Claim 17 is rejected per claim 15 with the rationale of the rejection of claim 5. Claim 17 is merely claim 5 recited as an apparatus.

f.   Claim 18 is rejected per claim 17 with the rationale of the rejection of claim 6. Claim 18 is merely claim 6 recited as an apparatus.

g.   Claim 19 is rejected per claim 17 with the rationale of the rejection of claim 7. Claim 19 is merely claim 7 recited as an apparatus.

h.   Referring to claim 21, Garland discloses the portion to be converged is an edge of a triangular polygon ("Our simplification algorithm is based on iterative contraction of vertex pairs" - page 2, column 2, paragraph 3 and Figure 10).

i.   Referring to claim 22, Garland discloses the portion to be converged is a surface of a triangular polygon (Figure 1).

4.   Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Garland in view of Li as applied to claim 15 above further in view of Zarge.

a.   Referring to claim 20, Garland discloses a minimum estimation value calculator which calculates a minimum estimation value (page 3, column 2, paragraph 4; page 5, footnote). Garland does not explicitly discloses a comparator which compares the minimum estimation value with a permissible value; and a determiner which determines a portion having the minimum estimation value as a portion to be converged when the minimum estimation value is equal or below the permissible value. Zarge

discloses a comparator which compares the estimation value with a permissible value; and a determiner which determines a portion having the estimation value as a portion to be converged when the minimum value is equal or below the permissible value (column 3, line 7-12 and Fig. 1). At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to modify the apparatus of Garland with a comparator which compares the calculated estimation values with a predetermined permissible value and a determiner which determines a portion having a estimation value as a portion to be converged when the minimum estimation value is equal or below the permissible value as taught by Zarge because it would allow the user to specify a target reduction ("The user can specify the target reduction..." - Zarge, column 4, lines 49-56).

Allowable Subject Matter

5.   Claims 2, 9-13, and 16 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Response to Arguments

6.   Applicant's arguments filed 12/1/03 have been fully considered but they are not persuasive. Applicant contends that Garland fails to teach calculating estimation values is made based on the distances between the respective surfaces of the polygon model before approximation and the vertices of the polygon model after approximation. However, the claims recite "...calculating estimation values for surfaces...based on distances between the respective surfaces after each deformation and all of the original vertices involved in the deformation..." As noted above, Garland discloses this limitation ("...We can associate a set of planes ...we can define the error of the vertex with respect to this set as the sum of squared distances to it planes... " - page 4, paragraph 1 and "...Compute the Q matrices for all initial vertices . . . The error . . . of this target vertex becomes the cost of contracting this pair... place all the pairs in a heap keyed on cost...Iteratively remove the pair...update the costs of all valid pairs involved..." - page 3, Section 4.1,paragraph 2). Regarding the

Applicant's argument that Li fails to disclose defining a reduction prohibition area as recited in the claims. As noted above Li discloses that the edge collapses are independent, i.e. consecutive edge collapse operations do not involve the same vertices (column 12, 1 lines 22-35), thus vertices involved in the first edge collapse are not allowed to be involved in the next edge collapse which is equivalent to the reduction prohibition area claimed.

Conclusion

7.   **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Linzy McCartney** whose telephone number is **(703) 605-0745**. The examiner can normally be reached on Mon-Friday (8:00AM-5: 30PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Mark Zimmerman**, can be reached at **(703) 305-9798**.

Any response to this action should be mailed to:

Commissioner of Patents and Trademarks

Washington, D.C. 20231

or faxed to:

(703) 872-9314 (for Technology Center 2600 only)

Hand-delivered responses should be brought to Crystal Park II, 2121 Crystal Drive, Arlington, VA, Sixth Floor (Receptionist).
Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Technology Center 2600 Customer Service Office whose telephone number is (703) 306-0377.

ltm
19 February 2004

MARK ZIMMERMAN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600